word. But we do not believe our author wishes to be taken seriously here :—

"Even if we postulate a Deity as the Originator of all things, yet the whole history of science, which is that of civilisation, proves that it is more profitable to seek the *explanation of natural phenomena in natural laws (His laws) than in infractions of them*—in miracles." (The italics are mine.)

We have one fault to find; in a work on the principles of heredity one would have expected a fuller discussion than is actually given of biometric and Mendelian methods of dealing with that phenomenon: medical men reading the book will get a very meagre idea of the nature of the investigation being carried on and of the definite results already achieved by these two sets of workers.

Dr. Reid does good service in dealing a blow at that teleology which is the curse of biological science by exposing the falsity of the old idea that the "object" of bi-parental reproduction is to ensure a sufficient degree of variability in each generation for natural selection to operate upon. He cites as evidence for this Dr. Warren's work on *Daphnia magna*; but does not refer to a more recent and more complete demonstration of the same truth by the same author in the case of Aphis, to be found in *Biometrika*, vol. i., p. 129.

These, however, are trifles, and do not detract from the value of the book as a whole. A. D. D.

MATHEMATICAL LECTURES FOR AMERICAN MATHEMATICIANS.

The Boston Colloquium. Lectures on Mathematics. By Edward Burr Van Vleck, Henry Seely White, and Frederick Shenstone Woods. Pp. xii+188. (New York: The Macmillan Company, 1905.) Price 2 dollars net.

Lectures on the Calculus of Variations. By Dr. Oskar Bolza. Pp. xvi+272. (Chicago: The University Press, 1904.) Price 4 dollars net.

AMONG the many ways in which the American Mathematical Society has endeavoured to popularise and develop the study of higher mathematics, not the least remarkable and useful is the practice of holding "colloquia" in connection with the summer meetings at intervals of two or three years. It had been felt that the mere reading of a long string of disconnected papers does not produce much lasting impression on the minds of the audience. On the other hand, even a short course of university lectures will often adequately cover a wide range of mathematical study. The society therefore decided in 1896 to arrange for courses of three to six two-hour lectures, each dealing with a substantial part of mathematics. Four such colloquia have been held, at Buffalo in 1896, at Cambridge in 1898, at Ithaca in 1901, and at Boston in 1903. At each of the first three two courses of lectures were given, and Prof. Oskar Bolza's course on "The Simplest Type of Problems in the Calculus of Variations," given at the Ithaca colloquium of 1901, forms the basis of one of the two volumes before us. The chapters nearly follow the historic order laid down in the introduction, which is also in close conformity with a logical sequence of treatment. The study of the first and second variations of an integral naturally leads to Weierstrass's examination of the conditions for a minimum and the distinction between a "strong" and a "weak" minimum, a terminology introduced by Kneser. The next steps are represented by Weierstrass's theory of parameter representation, Kneser's general theory based on the properties of geodesics, and Hilbert's existence-theorem. For Weierstrass's work (much of which is contained in unpublished courses of lectures) the author has had recourse to his own notes of a course (by Weierstrass) which he attended in 1879, as well as to several other sets of lecture notes, including one on Prof. Schwarz's lectures at Berlin on the same subject.

At the next colloquium, held at Boston in September, 1903, three courses of lectures were given. The year marked the fiftieth anniversary of the appointment of Prof. John Monroe Van Vleck to the chair of mathematics at Wesleyan University, and it was fitting to the occasion that all the lecturers were Van Vleck's pupils, one of them being his son. Prof. Henry S. White, of North-Western University, is responsible for the course of three lectures on "Linear Systems of Curves on Algebraic Surfaces," Prof. Frederick S. Woods, of the Massachusetts Institute of Technology, for three lectures on "Forms of Non-Euclidian Space," and Prof. Edward B. Van Vleck, of Wesleyan University, for six lectures on "Selected Topics in the Theory of Divergent Series and Continued Fractions." A bibliography of literature on continued fractions extending over twenty pages concludes the last named discourse.

Long formulæ involving x and y are like little children—they ought to be "seen and not heard." The success of these colloquia when originally delivered must have been in some considerable measure due to the extent to which the authors have succeeded in dealing with ideas and their symbolical representations without giving tedious demonstrations *in extenso*.

INDUSTRIAL REFRIGERATION

Modern Refrigerating Machinery, its Construction, Methods of Working, and Industrial Applications. By Prof. H. Lorenz. *American Practice in Refrigeration.* By H. M. Haven and F. W. Dean. Pp. x+396. (New York: Wiley and Sons; London: Chapman and Hall, Ltd., 1905.) Price 17*s.* net.

IT is to be regretted that no treatise exists on this subject which contains an exhaustive investigation of the thermodynamical problems involved, and of the physical properties of the various gases used as media, with special reference to their practical application to refrigerating machinery. In works on thermodynamics, the matter is treated in general terms. The physical constants are found in scattered

tables, and even with such a well-known gas as carbon dioxide they have not been completely determined. It has become more and more necessary for the engineer or manufacturer to be familiar with the scientific researches and theoretical considerations which lie at the base of his industry, and Germany has come to be looked upon as the leader in fundamental work of this sort, but the "Neuere Kühlmaschinen" of Prof. Lorenz makes no pretence to be of this comprehensive character. While refrigerating machinery is sufficiently simple, the principles on which it is based are not so easy of comprehension to the working engineers and business men who use it industrially. As a handbook for men of this class and as a *résumé* of the subject, this manual has long been known in Germany and on the Continent. Various editions have been published as a volume of the "Technische Handbibliothek," and the present translation under the title of "Modern Refrigerating Machinery" is from the edition of 1901.

No space is taken up by a historical introduction, but after some pages of an elementary character on the principles of heat there follows a chapter on "Methods of Cold Production," which gives a well arranged and concise description of the manner in which refrigeration is produced by different methods and of the energy required. The chapter on compressors treats chiefly of the important details of the machines, and wisely does not touch upon matters which belong more properly to generic and not to special machine design, and has some instructive indicator diagrams. The chapters which follow deal with condensers and evaporators, the cooling of liquids and air, and the manufacture of ice. They describe clearly the chief features of the matter under discussion, and do not enter upon general descriptions from which it is difficult to decipher the essential points. The pages devoted to very low temperatures, written four years ago, have now become merely of historical interest. The final chapter, on the performance of refrigerating machines, or, as the translator calls it, "The Yield of Cooling Machines," contains the only higher mathematics in the book, which contrast rather strangely with some of the simple definitions at the beginning. The translation is poor. The German original is closely followed. Such sentences as "tightness towards gases requires, besides faultless material, as small a number as possible of tubulures and stuffing boxes" are not very clear to an English mechanic, nor does the constant use of italics for the more important words add to the attractiveness of the pages. The illustrations are numerous and excellent, and the cuts are superior to those in the German edition.

In the same volume, though the pages are numbered consecutively, is a separate work on "American Practice in Refrigeration." It contains some admirable illustrations and useful data in regard to the construction of cold storage rooms, but it is not quite apparent what purpose the American authors could have in view in reprinting tables from such well-known books as those of Siebel and Wallis-Tayler.

C. H. B.

OUR BOOK SHELF.

The Geography of New Zealand. By P. Marshall. Pp. x+401. (Christchurch, N.Z., and London: Whitcombe and Tombs, Ltd., n.d.)

THE author claims to have written "according to the spirit of the New Geography," to give due consideration to the influence that the relief of the land has upon the circulation of the atmosphere, the climate, the distribution of flora and fauna, and the settlement of population; he explains that the latter is influenced considerably by the distribution of mineral deposits, while the nature of the industries affects the commerce of the country and shapes its political institutions.

The work is for this purpose divided into three parts, under the headings (1) historical, (2) physical, (3) political and commercial. There is a valuable introduction by Prof. Gregory, and an important chapter on geysers by the same writer, in which, however, he erroneously alludes to Strokur as being still an active geyser, whereas it ceased to erupt in 1895. The chapter on earthquakes by Mr. G. Hogben deserves special mention; the several kinds of earth movements and their registration by the seismograph are described. Of special interest to all lovers of Ao te Roa—the unscientific reader as well as the geographical student—are the chapter on the Maoris, by Mr. A. Hamilton, and the descriptions of various unique natural beauties.

At times the style is very explanatory and the matter original. Occasionally the author's meaning is somewhat vague, as when he writes:—"the high mountainous land here reaches the sea, and is in fact truncated by it." But on the whole the information given is accurate and concise, and the arrangement throughout careful.

As stated in the preface, the book is not merely the result of the author's and his contributors' personal observation, but is a collection of facts and figures from the previous writings of acknowledged authorities on the islands of which it treats. The letterpress is profusely illustrated with maps, reproductions of photographs, sketches, and old prints. These are all interesting, and many of the sketch-maps serve well to illustrate the text.

M. G. B.

Wild Wings; Adventures of a Camera-Hunter among the Larger Wild Birds of North America on Sea and Land. By H. K. Job. Pp. xxv+341; illustrated. (London: A. Constable and Co., Ltd.; Boston and New York: Houghton, Mifflin and Co., 1905.) Price 10*s.* 6*d.* net.

DESPITE its somewhat pedantic title, this book is much above the average of works of the same general nature, and deserves a wide circulation, if only on account of the earnest plea made by its author that the camera may, at least to some extent, be substituted for the shot-gun in our intercourse with birds. In this laudable endeavour he is supported by the President of the United States, who, after stating that wild-game shooting, under proper restrictions and regulations, must be considered legitimate so long as we breed domesticated animals for slaughter, observes that "there is altogether too much shooting, and if we can only get the camera in place of the gun and have the sportsman sunk somewhat in the naturalist and lover of wild things, the next generation will see an immense change for the better in the life of our woods and waters."

The special feature of Mr. Job's book is undoubtedly formed by the illustrations, all of which, we are told, are reproductions—and very excellent ones—of photo-